

New *Eleocharis* (Cyperaceae) from Venezuela

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ABSTRACT. Seven new species of *Eleocharis* are described based on study of material from the Venezuelan Guayana: *Eleocharis alveolatooides*, *E. atropiculata*, *E. ayacuchensis*, *E. eglerioides*, *E. liesneri*, *E. steyermarkii*, and *E. venezuelensis*. *Eleocharis squamigera* is represented in the Venezuelan Guayana by a newly described subspecies, *E. squamigera* subsp. *straminea*, differing primarily in the pale color of the rhizome scales and glumes. Two new forms are also described, *E. debilis* forma *anomala*, differing from the typical form in having 3-branched styles and trigonous achenes mixed with the characteristic 2-branched styles and biconvex ones of this species, and *E. geniculata* forma *brunnea*, differing from typical *E. geniculata* in its brown achenes.

While compiling the treatment of *Eleocharis* R. Brown (Cyperaceae) for the flora of the Venezuelan Guayana project, several new and noteworthy taxa were discovered. Seven species, a subspecies, and two forms are described in this article. Several other potential new species and taxa requiring further study are present in the study area, and some of them are discussed, but not formally described, either because the material representing them is inadequate, or because they belong to groups where the species are very poorly understood.

Several morphological features are recorded here for the first time in *Eleocharis*, or in a particular group of *Eleocharis*, as follows: (1) branched, dimorphic culms (in *E. eglerioides* and in an undescribed species); (2) functionally staminate aerial spikelets (in *E. alveolatooides*); (3) isolated trigonous achenes mixed with the biconvex ones in a species of the section *Eleogenus*; and (4) basal, subterranean spikelets in species of section *Eleogenus* (formerly recorded only for species of sect. *Eleocharis*, series *Tenuissimae*).

In the descriptions, all measurements of the achenes include the rostrum (tubercle).

Eleocharis alveolatooides S. González & Reznicek, sp. nov. (Subgen. *Eleocharis*, series *Tenuissimae*, subser. *Chaetariae*). TYPE: Venezuela. Bolívar: Distrito Piar, lower section of Río Ambutuir, along trail to Uriman, 05°26'N, 62°40'W, 500 m, 1 Dec. 1982, G. Davidse & O. Huber 23075 (holotype, MICH; isotype, MO).

Perennis, interdum annualis; rhizomatibus tenuissimus, oblique ascendente vel verticalibus; culmis 3–20 cm longis, 0.2–0.5 mm latis; vaginis scariosis, leviter inflatis ad apicem. Spiculis (4.5–)6–7.6 mm longis, linearis, acutis, plerumque staminatis praeter basalis fertilis; glumae florigerae 2–4, 4.2–6.3 mm longae, straminae vel purpurascens. Achenium in basi culmorum situm, 2.0–2.6 mm longum, 1–1.3 mm latum, trigonum, obovatum, albidum vel pallide olivaceum, cancellatum; rostrum lanceolatum, acuminatum; setae hypoginae 4–6 vel abscens. Stylo trifido; antherae 2.2–2.5 mm longae. *Eleocharis alveolatae* Svenson affinis.

Perennial (sometimes annual?); rhizomes delicate, branched, loosely ascendent to vertical; culms 3–20 cm long, 0.2–0.5 mm wide, green, sometimes red-punctulate, deeply angular sulcate to channeled, erect; sheaths loose, scariosus, red or purple at the base, hyaline and somewhat inflated at the apex. Spikelets (4.5–)6–7.6 mm long, 0.7–1.3 mm wide, linear, acute, with 2–4 glumes, usually staminate, flattened, sometimes proliferous, the achenes growing solitary among the bases of the culms; glumes 4.2–6.3 mm long, 1–2 mm wide, membranous, linear-lanceolate, keeled, acute, with a narrow green to stramineous midvein and striolated, stramineous to dark purple sides, the margin and apex hyaline, the lowest glume reaching $\frac{2}{3}$ to almost the length of the spikelet. Achene 2.0–2.6 mm long, 1–1.3 mm wide, trigonous, globular-obovoid, shortly and thickly stipitate, white to light olivaceous, deeply cancellate, each side with about 12–19 longitudinal series of 18–24 hexagonal or \pm circular pits; rostrum 0.9–1.4 mm long, triangular-lanceolate, acuminate, broad at the base and usually deeply 3-lobulated and decurrent on the angles

Table 1. Morphological comparison of *Eleocharis alveolatooides* and *E. alveolata*.

Characters	<i>E. alveolatooides</i>	<i>E. alveolata</i>
Rhizome	present	absent
Culm length (cm)	3–20	2–5
Culm width (mm)	0.2–0.5	0.1–0.2
Spikelet length (mm)	(4.5–)6–7.6	1.8–3.6
Glume length (mm)	4.2–6.3	1.6–3
Glume width (mm)	1–2	0.9–1.3
Achene length (mm)	2.0–2.6	1–1.4
Achene width (mm)	1–1.3	0.5–0.7
Longitudinal rows of cells/face	12–19	11–12
Number of cells per row	18–24	15–16
Rostrum length (mm)	0.9–1.4	0.3–0.5
Bristles	4–6, or absent	absent
Anther length (mm)	2.2–2.5	1.1–1.5

of the achene, light brownish; hypogynous bristles 4–6 or absent, shorter or slightly longer than the achene, flat, light brown colored, finely toothed or smooth. Style trifid. Stamens 3, anthers 2.2–2.5 mm long, the connective short-prolonged.

Distribution. Probably endemic to the Venezuelan Guayana, thus far known only from the collections cited. In shallow water of ponds or along river edges, at about 500–1100 m. Fruiting in November, December, and March.

This species differs from *Eleocharis alveolata* Svenson in having slender, branched vertical rhizomes; longer, thicker, erect culms; spikelets and achenes twice as large; longer anthers; and the presence of bristles. Table 1 shows the main differences between the two species, which are similar in having linear-acute mostly staminate aerial spikelets with only 2–4 glumes, and achenes situated at the base of the plant. These two species also have deeply cancellate, obovate, stipitate achenes narrowed at the base and apex, with the rostrum elongate, trigonous, and acuminate from a broad base. *Eleocharis alveolata* Svenson [Ekman 17788 GH, the type], was described from Cuba, and cited from Brazil. Later, Svenson (1937: 238) treated the collections from Brazil doubtfully as *E. glauca* Boeckeler (“since the material is too poor for definite determination”). *Eleocharis alveolatooides* is also vegetatively similar to the North American *E. baldwinii* (Torrey) Chapman, which differs in having fertile aerial spikelets and much smaller, darker and obscurely striolate achenes.

In *Eleocharis alveolatooides* the aerial spikelets are functionally staminate, the fruits being restricted to basal spikelets. Aerial male spikelets and ba-

sal female spikelets have been reported for the Australian genus *Crosslandia* (Bruhl, 1994), but the existence of some specimens of this genus with bisexual aerial spikelets was also recorded by Bruhl et al. (1992). Although only male aerial spikelets are known from *E. alveolatooides*, it is possible that bisexual aerial spikelets may occur.

Paratypes. VENEZUELA. **Bolívar:** Distrito Piar, at top of Salto Aicha near eastern base of Uaipan-tepui, 62°32'W, 5°38'N, 1100 m, 27–28 Nov. 1982, G. Davidse & O. Huber 22859 (MO); road along the río Carao above Canaima, to Camp Ucaima, 550 m, 30 Mar. 1969, H. Hertel & B. & F. Oberwinkler 15304 (VEN).

***Eleocharis atropiculata* S. González & Reznicek, sp. nov.** (Subgen. *Eleocharis*, sect. *Eleo-genus*). TYPE: Venezuela. Amazonas: Depto. Atabapo: Cerro Marahuaca, cumbre, parte central de la Meseta Sur-Este, a lo largo de la Quebrada Yekuana, 3°40'30"N, 65°26'20"W, 2560 m, 10–12 Oct. 1983, J. Steyermark 129582 (holotype, MO; isotype, NY).

Eleochari sellowianae affinis sed culmis 0.3–0.6 mm latis, spiculis paucifloris, glumis atrobrunneis vel atropurpureis, fere nigris, setis rufescentis differt.

Perennial, densely caespitose but with the tufts connected by slender stolons covered with long scales; culms 2–8 cm long, 0.3–0.6 mm wide, soft, somewhat spongy, longitudinally sulcate, very minutely white-punctulate, erect; sheaths scarious, brown to black at the base, hyaline, inflated, rugose and divided at the apex. Spikelets 2–3.8 mm long, 1–1.5(–1.8) mm wide, ovate, the apex acute or subclaviform with the apex truncate, 2–7-flowered; glumes 1.4–2.4 mm long, 0.9–1.2 mm wide, the lowest ½ to almost the length of the spikelet, membranaceous, ovate, acute or obtuse, with a broad, green to stramineous midvein, and dark brown or purple, almost black sides, very narrowly hyaline or not hyaline at all at the apex. Achene 1.2–1.6 mm long, 0.6–0.8 mm wide, biconvex, obovate, narrowed to the base, olivaceous to dark brown, minutely punctulate; rostrum 0.3–0.5(–0.6) mm long, lanceolate to mucroniform, acute to acuminate, ¼–½ the width of the achene, brown or whitish; hypogynous bristles 5–8, longer than the achene, dark reddish or brown, retrorsely toothed. Style bifid. Stamens 3, anthers 0.9–1.1 mm long, the connective inconspicuous.

Distribution. Probably endemic to the summit of Cerro Marahuaca, in the Territorio Federal Amazonas, on shallow ponds or along streams at 2300–2560 m. Fruiting is known from February and October.

Closely related to *Eleocharis sellowiana* Kunth, but having narrower culms, shorter, fewer-flowered, and much darker spikelets, dark colored bristles, and slightly darker and larger achenes. Other related species are *E. flavescens* Kunth and *E. olivaceonux* Simpson. *Eleocharis atropiculata* can be separated from *E. flavescens* by its longer achenes, shorter and darker glumes, and darker bristles, and from *E. olivaceonux* by the enlarged, inflated apex of the sheaths (vs. narrowly acute), shorter spikelets, and longer achenes. The dark color of the glumes is a character common in species from high elevations.

Paratype. VENEZUELA. Amazonas: Depto. Atabapo, Cerro Marahuaca-Fhuif, cumbre, 3°35'N, 65°20'W, 2330–2470 m, 3–4 Feb. 1982, J. Steyermark, M. Guariglia, N. Holmgren, J. Luteyn & S. Mori 126098 (VEN).

Eleocharis ayacuchensis S. González & Reznicek, sp. nov. (Subgen. *Scirpidium*). TYPE: Venezuela. Amazonas: Depto. Atures, en la carretera Pto. Ayacucho hacia El Burro, km 48, en el cruce de Betania de Topocho, laja 1 km al Este, 5°58'N, 67°22'W, 31 July 1993, A. Gröger & A. Berg 1041 (holotype, NY).

Ut videtur annua; culmis 6–22 cm longis, capillaribus vel tenuioribus; vaginis scariosis, detergibilis. Spicula 2.2–7.8 mm longa, 8–60-flora, glumae floriferae 0.8–1.5 mm longae, purpurascens, in carina viridae vel albae, ima saepe vacua. Achenium 0.7–0.9(–1) mm longum, 0.3–0.4 mm latum, fere teretibus, album vel luteum, longitudinaliter 15–21-striatum, inter strias transversim 33–65 trabeculatum; setae hypoginae 4–6, brevis, albescentes. Stylo trifido; antherae (0.2–)0.3–0.4 mm longae.

Apparently annual; culms 6–22 cm long, 0.2–0.4 mm wide, or up to 0.8 mm wide near the base, soft, light green, angular-sulcate to channeled longitudinally, irregularly septate transversally, especially near the base, erect, forming slender tufts; sheaths loose, scarios, inconspicuous. Spikelets 2.2–7.8 mm long, 1.2–2.8 mm wide, ovoid to linear, ± acute, 8–60-flowered; glumes polystichous, 0.8–1.5 mm long, 0.7–1 mm wide, membranous, ovate to elliptic, obtuse to truncate, often split at the apex, with a broad green to white midvein and reddish to dark purple sides, the margin and apex hyaline, the upper glumes keeled distally, the lowermost usually sterile and less than 1/3 the length of the spikelet. Achene 0.7–0.9(–1) mm long, 0.3–0.4 mm wide, very obtusely trigonous, almost terete, ellipsoid to narrowly obovoid, pericarp very fragile, white to grayish or yellowish, iridescent, translucent, with 15–21 longitudinal series of 33–65 transverse trabeculae each, the longitudinal ribs not elevated; rostrum 1/2–3/4 as wide as the achene,

conic-triangular to deltoid, somewhat spongy and light colored when mature; hypogynous bristles 4–6, shorter than the achene, white, delicate, finely toothed. Style trifid. Stamens usually 2, anthers (0.2–)0.3–0.4 mm long, gray-green to pale yellow, the connective shortly prolonged; filaments shiny purple to white.

Distribution. Known only from two collections from the Estado Amazonas. Aquatic or subaquatic, at about 75–130 m. Fruiting known to occur in July, but probably throughout the year.

This is the only species of subgenus *Scirpidium* known from the Venezuelan Guayana, and it differs from all other species of *Scirpidium* (except *E. tucumanensis* Barros), in having the lowest glume usually sterile. It is similar to the North American *E. bella* (Piper) Svenson in having short (0.3–0.4 mm) anthers and many-flowered, polystichous spikelets, but *E. bella* has sheaths inflated at the apex (not fugacious), obovate to linear-obovate achenes with 18–30 trabeculae, and bristles absent. Collections of *E. ayacuchensis* have been determined as *E. bonariensis* Nees and *E. radicans* (Poiret) Kunth, but both of these species are perennials and have achenes with elevated ribs. *Eleocharis ayacuchensis* also differs from *E. bonariensis* in lacking creeping rhizomes, having much shorter anthers and glumes, and having polystichous spikelets. *Eleocharis radicans* has very short anthers, but it differs in the spongy culms, pale green scales, and few-flowered (usually < 12-flowered) spikelets. Given the large range of variation found in the widely distributed *E. acicularis* (L.) Roemer & Schultes [e.g., anthers (0.5–) 0.6–1.2 mm long; spikelets 1–24-flowered], and based only on the descriptions, one could consider *E. ayacuchensis* as just an extreme of that variation. However, *E. acicularis* is a rhizomatous perennial with the anthers longer than 0.5 mm, the lower glumes often subdistichous, and it grows at higher elevations, (600–)1500–3500 m.

Paratype. VENEZUELA. Estación de piscicultura de Puerto Ayacucho, terreno situado entre la carretera hacia Samariapo y la pista de aterrizaje del aeropuerto de Puerto Ayacucho, aprox. 5°37'N, 67°36'W, 14 Jul. 1977, O. Huber 870a (NY).

Eleocharis debilis forma ***anomala*** S. González & Reznicek, forma nov. (Subgen. *Eleocharis*, sect. *Eleogenus*). TYPE: Venezuela. Amazonas: Depto. Atabapo, Salto Yureba, Cerro Yureba, lower Ventuari, ca. 4°03'N, 66°01'W, 350 m, 14 Mar. 1985, R. L. Liesner 18670 (holotype, MICH; isotypes, CIIDIR, MO).

A forma *Eleochari debili* spiculis aeriis et interdum in

rhizomatibus situs; rhizomata oblique ascendente cum squamis purpureis instructa; vaginis scariosis, inflatis ad apicem; acheniis biconvexis raro trigonis differt. Perennis. Spiculis 3–6.5 mm longis, acutis, 2–8(–12)-floriferis; glumae floriferae subdisticae, 2.4–3.3 mm longae, straminae vel aureo-brunneae vel purpurascens. Acheniis 1.2–1.5 mm longis, in rhizomatibus situm ad 1 mm latis, in aeriis spiculis situm 0.6–0.8 mm latis. Antherae 0.6–0.9(–1.2) mm longae.

Perennial, rhizomatous, the rhizomes slender, pale brown, or covered by purple scales. Culms 5–14(–19) cm long, 0.2–0.4 mm wide, finely sulcate, light green, slightly recurved; upper sheaths scarious, stramineous or purple at the base, hyaline and inflated at the apex. Spikelets 3–6.5 mm long, 1–2(–2.8) mm wide, ovate, acute, somewhat flattened, 2–8(–12)-flowered; glumes subdistichous, 2.4–3.3 mm long, 0.9–1.4 mm wide, the lowest $\frac{2}{5}$ to $\frac{3}{5}$ the length of the spikelet, membranaceous, elliptic to lanceolate, acute, with a narrow, green to stramineous midvein, and stramineous, golden brown or purple sides, the apex and margins narrowly hyaline; basal spikelets present, 1–3-flowered, occurring along the rhizomes as well as among the culms, chasmogamous, with long, slender styles. Achene 1.2–1.5 mm long, 0.6–0.8 mm wide on the aerial spikelets, up to 1 mm wide on the basal spikelets, biconvex or rarely trigonous, obovoid, shortly stipitate, dark purple to black, almost smooth; rostrum (0.25–)0.3–0.4(–0.45) mm long, triangular to deltoid, acuminate, broad and free at the base, $\frac{1}{2}$ – $\frac{2}{3}$ the width of the achene, whitish; hypogynous bristles 7–8, longer than the achene, dark reddish or brown, retrorsely toothed. Style bifid. Stamens 1–2, anthers 0.6–0.9(–1.2) mm long, the connective inconspicuous.

Distribution. Known from the Depto. Atabapo, Territorio Federal Amazonas, on hard, igneous rock banks of river and waterfall, patches of soil along river, and adjacent forest, at 350 m. Fruiting known in March.

Eleocharis debilis belongs to section *Eleogenus*, series *Maculosae*, which has 2-branched styles and biconvex achenes. The name *anomala* given to this form refers to the 3-branched styles and trigonous achenes mixed with the characteristic 2-branched styles and biconvex achenes of this group. This plant also differs from the forma *debilis* in having basal, sometimes proliferous spikelets growing both along the rhizome and among the culms, whereas in the forma *debilis*, when basal spikelets are present they occur only among the culms.

Eleocharis debilis has been described with smaller achenes (1–1.3 mm) and uninflated (or very slightly inflated) upper sheaths. According to Sven-

son (1939), the type of *E. debilis* is an annual, with whitened, acute (polystichous) spikes; however, he considered *E. macra*, with “perhaps a perennial rootstock,” as apparently the same species. The form here described is also more or less similar to *E. capillacea* Kunth in the type of rhizomes, recurved culms, and aspect of the achenes, but it differs mainly in the longer culms and achenes, spikelets up to 12-flowered, and presence of basal spikelets. Plants from Minas Gerais, Brazil (e.g., Irwin, Harley & Onishi 29531 and 29601, MICH), with achenes up to 1.5 mm and ascendent, purple scaly rhizomes, could be related to the plant described here. They differ in having the apex of the sheath not inflated, and shorter (1.7–2.6 mm) glumes. The closely related *E. sintenisii* Boeckeler, from the West Indies, has also wide-creeping rootstocks, as well as black achenes up to 1.5 mm long, but it differs in the relatively firmer, acute, and not inflated apex of the upper sheath.

Similar basal spikelets along the rhizome and same aspect of the achenes are present in a form of *E. maculosa* (Vahl) Roemer & Schultes, known from Guatemala and Honduras. Its achenes are small (1–1.3 mm) or up to 1.6 mm long [e.g., L. O. Williams et al. 43412 (MICH)], otherwise being similar to the typical form. It differs from the plant here described in having the lowest glume ovate to orbicular, (1.4–)1.7–2.4 mm wide, less than $\frac{1}{2}$ the length of the spikelet, with a conspicuous, often split, membranous apex up to 1.9 mm long; and spikelets 4.5–13 mm long, up to 4 mm wide, and usually dark purple colored. Prior to the records of amphicarpny here presented for species of section *Eleogenus*, this feature was known in *Eleocharis* only for species of section *Eleocharis*, series *Tenuissimae*.

Eleocharis eglerioides S. González & Reznicek, sp. nov. (Subgen. *Limnochloa*). TYPE: Venezuela. Bolívar: Río Los Borrachos, between Santa Elena de Uairen and Brazilian frontier, 1.2 km N of Brazilian boundary, 1000 m, 3 Jan. 1975, J. Steyermark 111368 (holotype, VEN, mixed with *Websteria confervoides*).

Egleriae fluctuanti L. T. Eiten modo ramificationibus, vaginatis culmis instructa et spiculae similis, sed differt fertile culmis non verticillatis in extremitatibus culmis tantum, acheniis superficie in quoque lateris 7–10-seriatis striatis cum cellulis transverse elongatis vel isodiametricis, inter strias leviter prominentibus, rostrum conicum vel obtuse-deltoidum, maturitate nigrum; setae hypoginae rudimentaris vel absens.

Perennial, submerged aquatic, rooting in substrate. Main culms (rhizomes) elongated, noded, in-

ternodes 1–4 cm long, 0.5–1.1 mm wide, each node with a membranous, tubular sheath 7–17 mm long, open distally, rounded or acute at the hyaline apex, purple colored at least at the base; main culms branched from the nodes with false whorls of secondary culms 0.1–0.4 mm wide, false whorls lateral, alternately left and right along the main culm, the secondary culms sheathed at the base; fertile culms short, 1.6–4.6 cm long, pedunculiform, solitary on the 3–4 distal nodes of the main culm, with 2–4 secondary culms growing from the same node, fertile culms long sheathed, the sheath sometimes reaching up to the spikelet. Spikelets cylindrical, 7–10 mm long, 1.3–1.5 mm wide when mature, 6–9-flowered, lowest glume fertile, sheathing the base of the spikelet, 2.6–4 mm long, appearing to be a continuation of the culm, pale green, ecarinate, the midnerve scarcely differentiated from the numerous and closely spaced lateral nerves, the margin and apex hyaline, easily torn; achenes 1.4–1.6 mm long (including the rostrum and stipe), 0.7–0.8 mm wide, obovoid to ellipsoid, plano-convex or compressed-trigonous, the abaxial angle represented by a wider and lighter ridge, each side with 7–10 rows of transversely elongated cells, which become isodiametric at the base of the achene, whitish to straw-colored; rostrum 0.2–0.3 mm long, conic or campanulate, dark brown to black; stipe \pm 0.1 mm long, dark brown; bristles absent or 1–2, rudimentary; stamens (usually?) 2, the filaments short, anthers with two spongy, white basal appendages.

Distribution. Known from Venezuela, very close to the Brazilian border, and from a widely disjunct area in Bolivia, as a submerged aquatic in running water, at elevations of 50 and 1000 m. It is very possible that it is distributed in much of the intermediate area, in the Amazonas basin, and that some specimens identified as *Egleria* or *Websteria* in herbaria correspond to this plant. Fruiting known in January and February.

An annotation by S. S. Hooper (27 Feb. 1979) on the type specimen indicates that she recognized this plant as a new species: "*Eleocharis* sp. nov. *Egleria* (*Eleocharis*) *fluctuans* affinis." It was followed by a short Latin diagnosis. However, apparently Hooper never published it. The annotation also indicates her idea about reducing *Egleria* under *Eleocharis*, based probably on the striking morphological similarities between the plant here described and *Egleria fluctuans*. The only apparent differences we could find between *Egleria* and *Eleocharis* are: (a) the arrangement of the fertile culms, appearing whorled at the end of branches of the rhizome, among few to many capillary culms

in *Egleria*, and solitary on the distal nodes of the rhizome, with only 2–4 secondary culms at the same node in *Eleocharis*; and (b) the type of rostrum, continuous with the body of the achene and widest at the middle, narrowing where it joins the achene in *Egleria*, and articulated and conic in *Eleocharis* (the articulate nature evident even in immature achenes). Other differences between *Eleocharis eglerioides* and *Egleria fluctuans* do not have a generic significance: the basal sheaths of the fertile culms in *E. fluctuans* (which are up to 15.2 cm long) are relatively short (0.3–2 cm long), membranous and hyaline, not covering most of the culm as in *Eleocharis eglerioides*, and the spikelets in *Egleria* are usually purple colored rather than pale green. As Eiten (1964) pointed out, *Egleria* has presumably evolved from a branched species of *Eleocharis*. The strong similarity of *Egleria* to *Eleocharis eglerioides* may suggest a relatively recent origin of *Egleria*.

Eleocharis eglerioides seems to be related to *E. elongata* Chapman and *E. robbinsii* Oakes, in the subgenus *Limnochloa*. Both species sometimes have trigonous or plano-convex achenes, with the abaxial angle and also the rostrum being similar to those of *E. eglerioides*. However, in *E. elongata* and *E. robbinsii* the epidermal cells of the achene are clearly transversely elongated, and robust, toothed bristles are present. In aquatic forms of *E. elongata* and *E. robbinsii* (e.g., Fernald & Long 325, MICH), the first steps in the evolution of noded, branched, dimorphic culms are observed in the form of pseudoverticillate, noded, stoloniferous culms borne from the base of the fascicles of erect culms, sometimes with slenderer secondary culms from the nodes. Whorls of capillary culms growing at the apex of the main culms are also known from the subgenus *Eleocharis*, in aquatic phases of the *E. retroflexa* complex.

The species here described is the only species in *Eleocharis* in which basal appendages of the anthers have been reported, similar to those in *Egleria*; however, slightly thickened bases of the anthers in *E. elongata* (e.g., Nash 944, MICH), could represent the first steps in the evolution of this feature, presumably useful in flotation. The anther appendages are slightly more prominent in the species here described than in *Egleria*.

The new species has been also confused with the genus *Websteria* (e.g., Anderson 12013, US), originally determined as *Scirpus* [*Websteria*] *confervoides* and later as *Egleria*. *Websteria* has been included in *Eleocharis* by Hooper (1973), Koyama (1985), and Tucker (1987). Eiten (1964) considered that *Websteria* evolved, like *Egleria*, from *Eleocharis*,

but "from another part of the genus." *Eleocharis eglerioides* differs from *Websteria* mainly in the branching pattern of the main culms, the multiflorate spikelets, and in the plano-convex or compressed-trigonous, clearly tuberculate, bristleless achene. In fact, the achene of *Websteria* (biconvex, etuberculate but pointed at the apex into a cylindrical prolongation) seems to be more similar to achenes of *Scirpus* s.l. than to any species of *Eleocharis*.

Paratype. BOLIVIA. Depto. Beni: 10–15 km SW of Guayamerin on road to Fíberalta, edge of forest and adjacent drainage ditch with gently flowing water, \pm 50 m, 7 Feb. 1978, W. R. Anderson 12013 (US).

***Eleocharis geniculata* (L.) Roemer & Schultes**
forma **brunnea** S. González & Reznicek, forma nov. TYPE: Venezuela. Delta Amacuro: Depto. Pedernales (boundary with Depto. Tucupita), sand beach bordering open sandy mud flats and wet depressions, mouth of Caño Guiniquina, between Punta Araguabisi and Punta Baja, at Barra Guiniquina, 9°30'N, 60°58'W, 18 Oct. 1977, J. Steyermark, R. Liesner & F. Delascio 114868 (holotype, MO; isotype, NY).

A forma *geniculata* acheniis brunneis differt.

Annual in dense tufts. Culms 6–38 cm tall 0.3–1.1 mm wide; sheaths pale brown at the base, greenish above, with an oblique, hyaline apex. Spikelets 2.5–5 mm long, 2.5–4.5 mm wide, \pm globose to short ovoid, ca. 20–80-flowered; glumes 1.4–2.2 mm long, 0.9–1.4 mm wide, membranous, ovate to broadly ovate, obtuse, pale brown with hyaline margins and a darker brown center. Achene 0.9–1.0 mm long, 0.6–0.7 mm wide, obovoid, biconvex, brown to reddish brown, smooth, shiny; rostrum white, pyramidal, 0.3 mm wide at base; bristles absent to slightly exceeding the achene, reddish brown. Style bifid. Stamens 3, anthers 0.5–0.8 mm long.

It differs from the widely variable and widely distributed forma *geniculata* in the color of the achenes, which are consistently brown to reddish brown when mature in the form described here, and shiny black (sometimes brown when immature) in the typical form.

Distribution. Known only from the Territorio Federal Delta Amacuro, Depto. Pedernales, in sandy places, at 50 m.

Eleocharis geniculata forma *brunnea* can range from a delicate plant 6–15 cm long, with developed perianth bristles, to a relatively robust plant up to 38 cm long, the bristles very reduced to absent

(e.g., Steyermark et al. 114864). This last specimen was first recognized as a possible new variety by Guaglianone (1987, annotation label and drawing). Since this plant is known only from three collections from the same place and date, it is by no means certain that it is a morphogeographical variety. The shiny, black achenes of the widespread *E. geniculata* are, however, so distinctive that it seems reasonable to name this apparently local variant with brown to reddish brown achenes. It is also interesting because only purple to black, not brown, achenes were known previously from species of the subseries *Rigidae*, to which *E. geniculata* belongs.

Paratypes. VENEZUELA. Delta Amacuro: Depto. Pedernales (boundary with Depto. Tucupita), sand beach bordering open sandy mud flats and wet depressions, mouth of Caño Guiniquina, between Punta Araguabisi and Punta Baja, at Barra Guiniquina, 18 Oct. 1977, J. Steyermark, R. Liesner & F. Delascio 114864 (MO, NY); J. Steyermark, R. Liesner & F. Delascio 114930 (MO, VEN).

***Eleocharis liesneri* S. González & Reznicek, sp. nov.** (Subgen. *Limnochloa*). TYPE: Venezuela. Bolívar: Gran Sabana, ca. 10 km SW of Karaurin Tepui at junction of Río Karaurin and Río Asadon (Río Sanpa), gallery forest, 5°19'N, 61°03'W, 900–1000 m, riverbank, 23 Apr. 1988, R. Liesner 23698 (holotype, MO; isotype, NY).

Perennis, culmis cespitosis, 40–65 cm longis, 2–4.4 mm crassis, teretibus vel levissimae trigonis ad apicem, haud septatis, medulla spongiosa; vaginis scariosis, stramineis vel purpurascens; spiculis 1.6–2.4 cm longis, 3.9–4.5 mm crassis, 12–26-floribus, glumis 5.5–6.2 mm longis, angustatis; acheniis 2.8–3.2 mm longis, 1.6–1.9 mm latis, biconvexis, utroque lateris cum cellulis 23–26-seriatis striatis, ad apicem contractis.

Perennial, caespitose from coarse roots; culms erect, 40–65 cm long, 2–4.4 mm wide, terete or very obtusely trigonous at the apex, rigid, dull, dark green (when dry), many and finely white-striolated with rows of cells with large silica bodies; sheaths loose, scarious, open distally and easily torn, stramineous or purple at the base, membranous and subhyaline at the acute apex. Spikelets angular-cylindrical, 1.6–2.4 cm long, 3.9–4.5 mm wide, \pm acute, 12–26-flowered, glumes \pm in 4 rows, 5.5–6.2 mm long, 2.4–3.2 mm wide, rather loosely imbricate, oblong, obtuse to subacute, coriaceous, ecarinate, the midnerve scarcely differentiated from the prominent, numerous, and closely spaced lateral nerves, the sides green to brownish, the margin and apex abruptly hyaline, easily torn; lowest glume (fertile?), 3.8–4.8 mm long, sheathing the base of the spikelet, appearing to be a continuation

of the culm. Achenes 2.8–3.2 mm long, 1.6–1.9 mm wide, obovoid to broadly obpyriform, turgid, biconvex, each side with 23–26 rows of transversely oblong cells, which can become isodiametric at the base of the achene, shiny pale brown, at the apex contracted into a very short neck that is expanded at the base of the rostrum; rostrum 0.5–1 mm long, flattened, subquadrangular, widest at the base, grayish to black; bristles 6–7, in two series, united at the base, coarse, up to 5.2 mm long, stramineous to reddish brown, retrorsely toothed; stamens (usually?) 2, the filaments dark colored proximally, flattened and subhyaline distally.

Distribution. Known only from the type locality, in Estado Bolívar, Gran Sabana, on riverbank in a gallery forest, at 900–1000 m. Fruiting in April.

Though it could appear to be a slenderer form of *Eleocharis strobilacea* Pedersen, from Argentina and Paraguay, *E. liesneri* has narrower and fewer-flowered spikelets (12–26-flowered vs. up to 70-flowered), longer glumes with the exposed portion longer than broad, and wider achenes (1.6–1.9 mm wide vs. \pm 1.2 mm wide), with more abundant rows of cells per face, a truncate versus acute rostrum, and relatively longer bristles. Because of its terete culms, *E. liesneri* also bears a superficial resemblance to *E. interstincta* and *E. cellulosa*, differing from both of them in the narrower, coarsely nerved glumes, and in achenes contracted below the apex and then expanded at the base of the rostrum, which is thus broader than its articulation with the main body of the achene. Other differences from *E. interstincta* are non-septate culms and narrower spikelets. From *E. cellulosa* it differs in the longer glumes, the toothed bristles, and the longer rostrum of the achene. In the general aspect of the culms, spikelets, and glumes, *E. liesneri* is similar to the Australian *E. brassii* S. T. Blake, which, however, has the achenes deeply pitted, the epidermal cells hexagonal, the apex not or scarcely constricted, and the bristles smaller. The shape of the achene and rostrum are similar to those of *E. acutangula* and *E. philippinensis* Svenson, from which *E. liesneri* differs mainly in its terete rather than angular culms, longer glumes, and larger achenes with more rows of cells.

The species is named after Ronald Liesner, who collected the type, as well as many other interesting plants in Venezuela.

***Eleocharis squamigera* Svenson subsp. straminea** S. González & Reznicek, subsp. nov.
 TYPE: Venezuela. Bolívar: Mount Roraima, between Rondón Camp and base of sandstone bluffs, J. A. Steyermark 58985 (holotype, NY; isotype, NY).

Eleochari squamigerae Svenson subsp. *squamigerae* similis sed differt rhizomata cum squamis stramineis vel flavis vel atrobrunneis instructa; acheniis 1.2–1.4 mm longis, luteolis, in adaxialis lateris cum cellulis 9–12-seriatis striatis, inter strias non prominentibus.

Perennial, in tufts or sometimes more scattered on a scaly rhizome up to 1.3 mm thick, rhizome scales yellowish to dark brown. Culms 3–32 mm long, 0.2–0.5 mm wide, sometimes strongly curved; sheaths \pm loose, pale brown below, greenish above, oblique. Spikelets 2.5–5.5 mm long, ca. 1.5–3.5 mm wide, ellipsoid, 4–12-flowered; glumes 1.5–2.2 mm long, 0.9–1.2 mm wide, membranous, ovate, obtuse, whitish to pale yellowish. Achene 1.2–1.4 mm long, 0.6–0.8 mm wide, trigonous with thickened angles, obovate, buff to pale yellow, with 9–12 rows of cells but lacking pronounced ridges separating the rows; rostrum 0.4 mm wide, pyramidal, pale brown; bristles shorter than the achene, brown, Style trifold. Stamens 2, anthers 0.6–0.8 mm long.

The main differences between the subspecies *straminea* and *squamigera* are the straw or yellow to dark brown color of the rhizome scales in the former versus reddish to purple in the latter, the whitish to yellowish glumes versus pinkish to purple, and the color and ornamentation of the achenes, which are slightly larger, buff or pale yellowish, and lacking elevated longitudinal ridges separating the rows of cells in subspecies *straminea* versus pale yellowish to olivaceous or pale brown, with distinct longitudinal ridges in subspecies *squamigera*.

Distribution. Known from the State of Bolívar and Territorio Federal Amazonas, on forested slopes and along river banks, sometimes forming dense masses, at 1800–2255 m. *Eleocharis squamigera* was described from Jaguarahyva, Brazil (southwest of São Pablo).

In *Eleocharis squamigera* subsp. *squamigera*, the ornamentation of the achenes is similar to that of several species of subgenus *Limnochloa* (Svenson's *Mutatae*), i.e., several rows of trabeculae separated by longitudinal elevated costae. The achenes of the subspecies here described have an ornamentation more similar to that of several species of the subgenus *Eleocharis* series *Tenuissimae*, i.e., the longitudinal costae are not elevated and the shape of the cells varies from horizontal (trabeculae-like) to hexagonal or irregular.

Paratypes. VENEZUELA. Bolívar: Auyán tepui, cumbre de parte central del brazo noroeste (división occidental del cerro) al sur de avioneta de Jimmy Angel, J. A. Steyermark 93563 (NY, VEN); Chimantá Massif, Central Section, W branch of headwaters of Río Tirica above Upper Falls, 2091 m, 17 Feb. 1955, J. A. Steyermark &

J. J. Wurdack 915 (NY—2 sheets); Chimantá Massif, Torono-tepui, along banks of Cano Mojado, 1894–1909 m, 20 Feb. 1955, *J. A. Steyermark & J. J. Wurdack 959* (NY); Distr. Piar, Macizo del Chimantá, sector centro-noreste del Chimantá-tepui, cabeceras orientales del Caño Chimantá, 5°18'N, 62°09'W, ± 2000 m, 26–29 Jan. 1983, *J. A. Steyermark, O. Huber & V. Carreño 128201* (MO). **Amazonas:** Depto. Río Negro, Cerro de la Neblina, Camp II, 2.5–3.5 km NE Pico Phelps (= Neblina), 2085–2100 m, 28 Jan. 1985, *V. A. Funk 6715* (NY).

Eleocharis steyermarkii S. González & Reznicek, sp. nov. (Subgen. *Eleocharis*, series *Tenuissimae*, subseries *Sulcatae*). TYPE: Venezuela. Bolívar: km 201.9 (km “189–190” of carretera sign), carretera El Dorado hacia Santa Elena de Uairén, al sur de El Dorado, in dense clumps along swampy margin of stream, 1200–1400 m, 19–22 Feb. 1972, *J. Steyermark et al. 105478* (holotype, NY; isotypes, NY, VEN).

Perennis; culmis (15–)20–40 cm longis, (0.5–)0.7–2.2(–3) mm latis. Spiculis 5–11 mm longis, (2.1–)2.9–4.8 mm latis, ovatis vel lanceolatis, subacutis; glumae florum 2.5–3.6 mm longae, (1.2–)1.5–2.2 mm latae; acheniis (1.4–)1.5–1.9 mm longis, (0.7–)0.8–1 mm latis, obovatis vel orbicularis, rostris pyramidalis.

Perennial from short or somewhat elongated rhizomes. Culms (15–)20–40 cm long, (0.5–)0.7–2.2(–3) mm wide, often flexible and soft, not or finely sulcate, erect; upper sheaths scarious, red, purple or stramineous at the base, membranous, acute or sometimes torn at the apex. Spikelets 5–11 mm long, (2.1–)2.9–4.8 mm wide, ovoid to lanceoloid, subacute, (7–)15–40-flowered; glumes 2.5–3.6 mm long, (1.2–)1.5–2.2 mm wide, membranous to subcoriaceous, elliptic, obtuse to emarginate, with a green to stramineous midvein, and reddish to dark purple or almost black sides, the apex and margins broadly hyaline, the margin of the lowest glume 0.2–0.8 mm wide. Achene (1.4–)1.5–1.9 mm long, (0.7–)0.8–1 mm wide, trigonous to plano-convex, obovoid, obpyriform or orbicular, gradually stipitate, whitish to yellowish, almost smooth or finely longitudinally striolated; rostrum pyramidal, its base as broad as the apex of the achene, not or slightly decurrent on the angles, whitish to brown; hypogynous bristles 6–7, shorter or slightly longer than the achene, white to light reddish, retrorsely toothed. Style trifid. Stamens 3, anthers (0.6–)0.9–1.7 mm long, the filaments up to 2 mm long.

Distribution. Known from Estado Bolívar, forming dense clumps in wet savannas and along swampy margins of streams and rivers, 900–2120 m. Fruiting known from February to April.

Eleocharis steyermarkii is probably related to *E.*

pachystyla, from which it differs in having ovoid to ovoid-lanceoloid (vs. obovoid to rhomboid) spikelets; the lowest 1 mm of the rachilla with 0–4 transversely elongated scars (vs. lowest 1 mm with several closely placed transversely elongated scars, which are different from the prominent, not transversely elongated scars on the rest of the rachilla); middle glumes wider (2.5–3.6 × 1.5–2.2 mm vs. 2–3.1 × 1–1.2 mm); margins of lowest glume conspicuously hyaline (0.2–0.8 mm vs. 0.1–0.3 mm); and lighter colored bristles (whitish to light reddish vs. reddish to dark brown).

Delicate forms of *Eleocharis steyermarkii* could be confused with *E. filiculmis* Kunth or with *E. almensis* D. A. Simpson. From *E. filiculmis* they differ mainly in the larger glumes and achenes, and the less densely flowered, subacute spikelets. From *E. almensis* (holotype, *Harley et al. 25305*, K) they differ in the wider culms, larger, darker purple glumes, wider achenes that are capped by a rostrum as wide as the achenes, and larger anthers.

Paratypes. VENEZUELA. Bolívar: Gran Sabana, ca. 10 km SW of Karaurin Tepui at junction of río Karaurin and Río Asadon (Río Sanpa), 05°19'N, 61°03'W, riverbank, 900–1000 m, 20 Apr. 1988, *R. Liesner 23487* (MICH); Chimantá Massif, central Section, swampy depression in wet savanna along E branch of headwaters of Río Tirica, 12 Feb. 1955, *J. Steyermark & J. J. Wurdack 761* (NY—2 sheets, VEN); Laguna al oeste del Río Cuchivero, en las proximidades de este, 27 Dec. 1976, *B. Trujillo 14358* (MY–Maracay).

Plants probably belonging to *E. steyermarkii* are: VENEZUELA. Bolívar: Gran Sabana, San Ignacio de Yuruaní, morichal, 05°00'N, 61°10'W, 850 m, 4 May 1988, *R. Liesner 24208* (CIIDIR, MICH) [but achenes 0.6–0.8 mm, pale brown, punctulate]; vicinity of road campamento 150 at km 150 in valley of savanna of Río Uarama below Uarama-tepui, NE of Luepa, 1220 m, Apr. 1960, *J. Steyermark & S. Nilsson 606* (NY, VEN) [but rigid, deeply sulcate culms].

The species is named after Julian Steyermark, in honor of his many important contributions to the botany of Latin America.

Eleocharis venezuelensis S. González & Reznicek, sp. nov. (Subgen. *Eleocharis*, sect. *Eleocharis*, ser. *Tenuissimae*). TYPE: Venezuela. Apure: Dtto. Pedro Camejo, Parque Nacional Santos Luzardo, sect. 2, Fundo “La Guacharaca,” 30 km SE de margen derecha del Río Capanaparo, aprox. 6°42'N, 67°32'W, 50 m, 31 Mar. 1989, *G. Aymard, N. Cuello & R. Schargei 7405* (holotype, MO).

Eleocharis retroflexae affinis sed culmis robustioris, spiculis (4.5–)5.2–9 mm longis, (1.5–)2–2.7 mm latis, glumis (2.6–)3.2–4.3 mm longis, acheniis (1.4–)1.5–1.7 mm longis, 0.7–0.9 mm latis, maturitate nigris, setis robustioris differt.

Perennial (sometimes annual?), densely caespitose, often profusely proliferous and appearing to be repeatedly branched; culms 5–12 cm long (much larger in aquatic phases), 0.3–0.5(–0.8) mm wide, dark green, sometimes very minutely white-punctulate, sulcate, erect and rigid, or floating; sheaths scarious, brown or purple at the base, membranous, hyaline and inflated at the acute or rounded apex. Spikelets (4.5–)5.2–9 mm long, (1.5–)2–2.7 mm wide, oblong to lanceolate, flattened, \pm acute, 7–16-flowered, often sterile and proliferous; glumes subdistichous, (2.6–)3.2–4.3 mm long, 1.2–1.8 mm wide, membranous, oblong to long-elliptic, prominently keeled, obtuse to acute, with a broad green to stramineous midvein and brownish to purple sides, the margin and apex broadly hyaline, the lowest glume $\pm \frac{1}{2}$ the length of the spikelet, the midvein closely and finely nerved, appearing to be a continuation of the culm. Achene (1.4–)1.5–1.7 mm long, 0.7–0.9 mm wide, trigonous, obovoid to \pm urceolate, truncate at the apex, narrowed to the base, pericarp yellowish to shiny dark gray or black, the dark layer easily falling off, leaving a yellowish to light brown wall, cancellate, each side with about 7–14 longitudinal rows of \pm circular pits; rostrum 0.4–0.5 mm long, high-pyramidal, acuminate, broad at the base and usually deeply 3-lobed and slightly decurrent on the angles of the achene, light brownish; hypogynous bristles 4–6 or absent, shorter or slightly longer than the achene, flattened at the lower half, white to light brown colored, finely toothed. Style trifid. Stamens 3, anthers 1.8–2.3 mm long, the connective short prolonged.

Distribution. Known from the states of Apure and Guárico, as an aquatic or subaquatic on sandy river banks and around lagoons, between 50 and 100 m. Fruiting known in March and December. The aquatic, proliferous plants are often sterile.

This species has been identified as, and is related to, *Eleocharis retroflexa*. However, *E. venezuelensis* has more rigid and coarse culms (in the terrestrial forms); larger spikelets, glumes, and achenes; the lowest glume with several close and fine nerves along the midvein; achenes with a brown to shiny black coat (easily fallen), and ornamentation less deeply cancellate as compared with that of *E. retroflexa*. The North American *E. vivipara*, also with dark, cancellate achenes, has polystichous spikelets and shorter achenes with the rostrum not decurrent. From *E. subfoliata*, *E. venezuelensis* differs mainly in the much larger glumes, larger and relatively more deeply cancellate achenes, and broader decurrent rostrum.

Paratypes. VENEZUELA. **Apure:** Dto. Pedro Camejo, Caño La Cochina de La Pica crossing, between the Río Cinaruco and the Río Capanaparo, aprox. 6°43'N, 67°48'W, 70 m, 2 Mar. 1979, G. Davidse & A. C. González 15988 (MO). **Guárico:** Dto. Infante, Parque Nacional Aguaro-Guariquito, Morichal San Ramón, ca. 9°40'–9°44'N, y 67°52'–67°56'W, 100 m, Dec. 1981, F. Delascio, R. Montes & G. Davidse 11416 (MO).

Eleocharis sp.

The *Eleocharis retroflexa* complex is much in need of a taxonomical and nomenclatural revision, and it seems unwise to describe yet another poorly known species in the group. However, some floating plants belonging to the *E. retroflexa* complex show a "Websteria-like" branching pattern not recorded previously in *Eleocharis*. This species has, in Stergios, Gutierrez & Stergios 11279 (MO), dimorphic culms, the fertile culms (0.1–0.3 mm wide) growing among whorls of abundant, capillary culms, successively giving place to secondary whorls, in up to five orders of branching. In *E. retroflexa* and other species with proliferous spikelets, branching is seen because of the proliferous habit, but the culms are not evidently dimorphic. In addition, *E. retroflexa* differs from the species here discussed in having obovoid to urceolate achenes truncate at the apex (vs. elliptic or long obovoid achenes narrowed to the apex), and high (vs. low) pyramidal rostrums. The rostrum type of this species is similar to that in *E. glauca*, which can be distinguished by its clearly polystichous, shorter glumes, shorter achenes (0.8–0.85 mm), and long stolons connecting the fascicles of culms.

Another collection, apparently of the same species, Trujillo & Pulido 15123 (MY–Maracay), growing as an emergent aquatic, lacks the successive verticils of culms, but its culms are evidently and repeatedly branched up to 2.5 cm above the base, with some of the secondary culms slenderer.

Specimens examined. VENEZUELA. **Amazonas:** Dto. Atures, 20 km de Pto. Ayacucho, carretera hacia El Burro, lajas de piedra asociadas con arroyo de manantial, 160–180 m, Sep.–Oct. 1987, B. Stergios, E. Gutierrez & P. Stergios 11279 (MO); alrededores de El Sipapo, \pm 28 km despues del cruce desde la carretera Puerto Ayacucho–Simariapo, 100 m, 22 Mar. 1979, B. Trujillo & J. Pulido 15123 (MY–Maracay).

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